

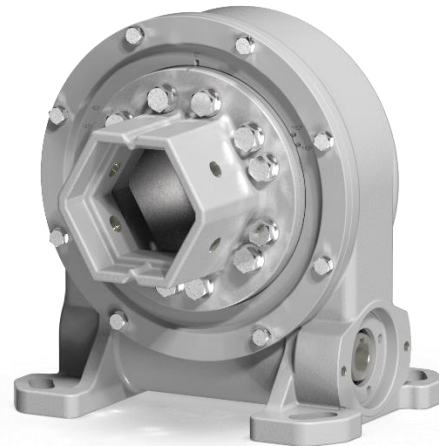


SLEW DRIVES

Solar

TVR (Vertical Series)

Installation & Maintenance Manual



UNIT CODE: <u>A</u> <u>XXX</u> – <u>ZB</u> – <u>CD</u>				
A:		Slew drive serie		
X:		Size		
B:		Other characteristics		
		0	With encoder output & Ø25mm shaft entrance	1, 2, ... Other special configurations
C:		Side of motor installation		
	L	Left side		
	R	Right side		
D:		Threads		
	M	Metric threads		
	I	Imperial threads		

Notice

- The following text includes notices and procedures which should be observed when installing the slew drives and during the maintenance.
- Read carefully this manual before any operation is performed. The working features can only be ensured if the steps have been followed correctly.
- All steps listed below must be carried out by qualified* personal.
- This manual should be kept near the structural element and has to be always accessible to the personal.
- The purchaser is responsible for protective measures and installation of all the equipment.
- Please contact our technical department for any further assistance.
- The technical data for each slew drives can be found in our data sheets.
- The contents and illustrations presented in this manual may vary for special versions.
- We reserve the right to make changes for the purpose of improvement and/or optimisation.
- Warnings in this manual are marked by the symbol (⚠) and/or signal words. Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury. It also indicates important points to be taken into account to avoid future problems once installed.

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1. Security

This section provides an overview of relevant safety aspects to ensure the protection of personnel as well as safe and trouble-free operation. Non-compliance with the operating instructions and safety guidelines provided in this manual may result in significant risks.

- **Trained:**

Ensure that the personnel involved have adequate knowledge of safety procedures, necessary tools and working protocols.

- **Personal Protective Equipment (PPE):**

Before starting any assembly or maintenance activity, personnel must wear appropriate personal protective equipment. This includes safety glasses, resistant gloves, hard hat, and safety footwear. Proper use of PPE helps prevent injuries and protects personnel from potential hazards.

- **Energy blocking:**

Before carrying out any work on the slew drive, make sure that all power sources are properly locked. This avoids the risk of accidental start-up during assembly or maintenance. Check that all switches are in the off position and fit locking devices to prevent unintentional activation.

The slew drives provide self-locking when the efficiency of the gearbox is less than 50%.

 **It is imperative to lock the load supported by the slew drive to ensure the immobilisation of the system.**

TGB shall not be liable for any damage or injury resulting from non-compliance with the previous point.

- **Visual inspection:**

Before carrying out any work, perform visual inspection of the slew drive to identify possible damage, wear, or loose parts. If any anomalies are detected, such as cracks, corrosion or worn components, corrective action must be taken before proceeding with assembly or maintenance.

- **Appropriate tools:**

Ensure that tools are in good condition and are used in accordance with the manufacturer's instructions. Use of unsuitable tools may damage the equipment or cause injury.

- **Safe loading and unloading:**

During assembly and disassembly of slew drives, use appropriate lifting equipment and follow safe loading and unloading practices. Ensure that equipment is properly

balanced and secured to prevent accidental falling or shifting that could cause injury or damage to the equipment.

- **Periodic maintenance:**

Establish a regular maintenance schedule for the slew drives according to the manufacturer's recommendations. This includes proper lubrication, inspection of components, tightening of bolts and any other necessary maintenance tasks. Fulfil with the maintenance schedule helps prevent failures and ensure safe and reliable operation.

- **Moving parts:**

 Do not insert hands and/or other body parts into moving parts during operation. Rotating components and/or components with linear movements can cause serious injury.

2. Transport, handling, and storage provision

-  • Transport only in an upright position, avoiding possible knocks and impacts on any part of the slew drive or motor. Such impacts could cause the sealing parts to become damaged.
- Wear work gloves and be careful when handling the slew drives. Some slew drives are generally provided with threaded holes in the upper surface of the housing into which eyebolts can be assembled. This enables safe handling on a hoisting device. The threaded length of the bolt should be at least 1.5 times the diameter of the bolt. It can also be handled using a sling that goes through the inner ring.
-  • If a motor is already installed, do not handle the assembly from the motor. This may cause small components that are not designed to support the full weight of the slew drive, become loose or damaged, damaging the sealing of the motor.



Image 1: Indications of do not manipulate from the motor.

-  • Store only in vertical position and in closed or covered spaces protected from rain and/or flooding.

3. Installation

3.1. Previous checks



- Check the slew drive for physical damage.
- Check that the slew drive turns smoothly. In case the slew drive does not turn, please check whether there is impediment, or check connection power (hydraulic or electric) to be sure it is properly in supply.
- If the slew drive makes noise, please check whether lubrication is good enough or the flatness of the slew drive is as required, or the rotation frequency is as expected.
- Check whether the dimension of the bolt is as expected.
- Check whether the type of the bolt (metric or imperial) is as expected.
- The slew drive is served in position $0^\circ \pm 3^\circ$, to ensure that it can perform the movement of $\pm 60^\circ$ without reaching the mechanical stop. If some measure is required use the next formulas to convert from degrees to mm or mm to degrees.

$$\text{Circular distance (mm)} = \frac{\text{Angle (}^\circ\text{)} * 6.28 * \text{Distance from center to measuring point (mm)}}{360}$$

$$\text{Angle (}^\circ\text{)} = \frac{360 * \text{Circular distance (mm)}}{6.28 * \text{Distance from center to measuring point (mm)}}$$

3.2. Clean the slew drive and the mounting structure



- Remove extraneous materials from supporting surfaces.
- Clean the outer mounting surfaces using a cold solvent that doesn't damage the rubber seals.
- Cleaning a Slew drive with steam jet or high-pressure cleaner is not permissible. May damage sealing gaskets.

3.3. Lubricate the Slew drive

The slew drive is supplied fully lubricated for the start operation and a maintenance must be performed during its lifetime. The bearings that support the geared ring are self-lubricated for life.

3.4. Choice of mounting bolts

As the gearbox manufacturer, we do not supply warrant or recommend the mounting fasteners used. Please take care in choosing this item that will attach our product to yours.

- Prescribed sizes, number and quality grades shall be used.
- All the holes in the slew drive must be used to fix it to the mounting structure.
- Grip ratio (grip length to diameter of bolt) shall be observed, from minimum ≥ 2 to maximum ≤ 10 .
- Bolts with a fully threaded shaft should not be used.

- Slew drive function, lifespan, and durability of the bolt connection are affected in case of non-compliance.
- To reduce the pressure on the material, the use of washers DIN6916 is recommended.
- Do not reuse bolts, nuts and washers and they must be replaced if they are in bad condition.

Materials	Max. surface pressure in MPa
QT450	310
50Mn / C45N / 46Cr2N	420
42CrMo4	700

Table 1: Table of admissible interfacial pressures.

3.5. Choice of tightening torques

Mounting bolts are in normal cases adequately secured by proper preloading using a torque wrench. The use of split rings, split washers, etc. is not permissible. The next table is for guidance:

Bolt (Normal pitch)	Tightening torque M_A in Nm (Non lubricated thread ($\mu_G=0,140$))		
	Quality class 8.8	Quality class 10.9	Quality class Inox - 70
M6	10	14	8.4
M8	25	35	20.4
M10	49	69	41
M12	86	120	70
M14	135	490	112
M16	210	295	173
M18	290	405	246
M20	410	580	351

Table 2: Tightening torques for Metric mounting bolts (non-lubricated thread).

3.6. Installation of the Slew drive

- Please note all the safety and handling points mentioned above in the relevant sections.
- With a gauge, check whether the Slew drives supporting surfaces are fully supported by the mounting structure.
- The slew drive shall be mounted in an unloaded condition.
- ⚠ • Open the upper plug, to equal the pressure. Due to differences in height, internal pressures can be generated, which must be eliminated to avoid possible sweating. If this happens, wipe with a rag.

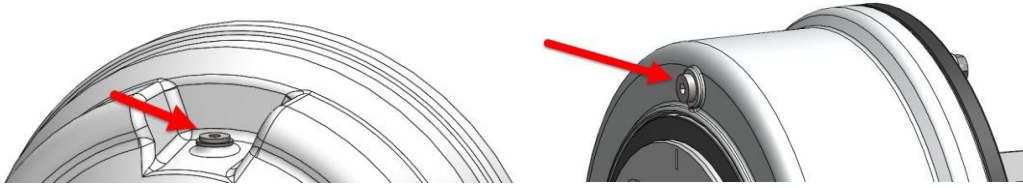


Image 2: Upper plug detail.

- Close the upper plug at 10Nm.
- First, the housing should be attached and then flanges on the gear ring.
- If it is required to adjust the position of the ring, it must be turned by actuating the screw worm. Whether using the motor or an adapter shaft.

“The use of breather valve it will be optional depending on pressure variation. In the case the upper plug was changed by a breather plug there will be no need on open the upper plug.”

The following procedure shall be followed in order to avoid deviations between bolt tightening forces.

- Slightly apply thread locker to the bolt threads (last three to five filets) in order to ensure uniform frictional resistance.
- Preload the bolts including washers in 3 steps: 30%, 80% and 100% of the tightening torque. The scheme below shows the order to be followed when tightening the bolts. (A generic model is shown, the number of screws may vary depending on the model).

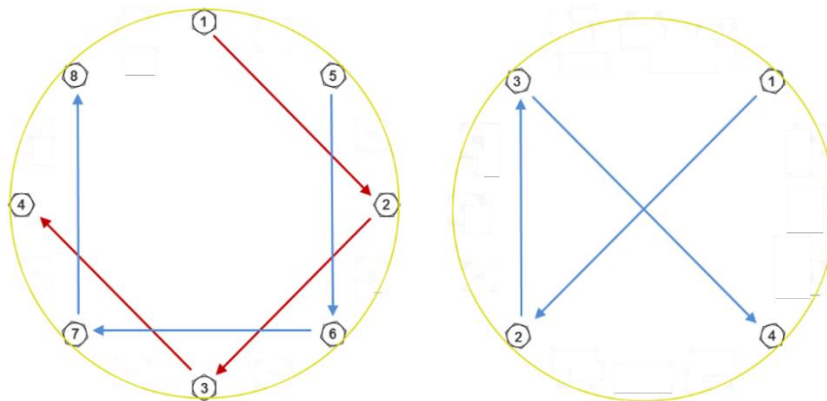


Image 3: Generic tightening torque procedure: Flanges (left), Housing (right).

- Repeat the procedure for the gear ring on both sides.
- Once the screw is tightened, make a mark in the surface of the screw and other structure surface. It is useful to inspect it.

3.7. Adapter flange assembly (if required).

- Match the mark on the flange with the mark on the ring. This is important as the other mark will be hidden. If the flange to be mounted does not have a mark, it is important to mark the position with a marker so that the position of the slewing ring module is

always known.

- Lightly apply thread locker to the screw thread (on the last 3 to 5 threads) to ensure uniform frictional resistance.
- ⚠ • Place the washer and bolt in the upper central hole. If not possible, careful from swinging sideways, this could cause damage to the operator and/or the paintwork. The bolt must be screwed in, but without tightening the bolt.

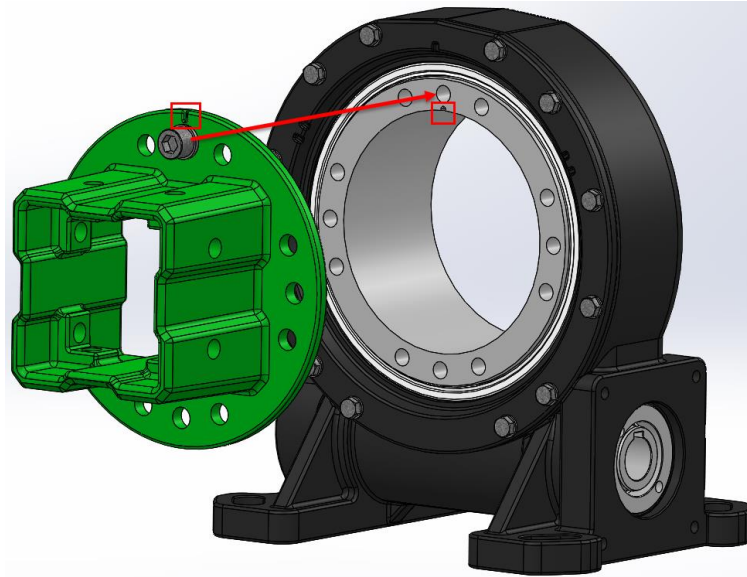


Image 4: Flange assembly on slew drive.

- Insert the rest of the bolts together with their washers. Lightly apply threadlocker to the threads of the screws (on the last 3 to 5 threads) to ensure uniform frictional resistance. Screw in as far as it will go without tightening.
- Set the torque wrench according to bolt size and quality (see *table 2*).
- Tighten the bolts in 3 steps (30%, 80% and 100% of the tightening torque) and in the order indicated in the picture, in order to avoid deviations between the tightening forces of the bolts. (See *Image 3*)

3.8. Motor installation and/or connectors.

- If the motor is not already installed on the slew drive or is not in the final operating position, see "TGB Solar DC Motors - Installation manual" for more detail.
- Check the motor before installing it, whether the shield is intact, the power is expected, or there is electric protector for motor (in case of AC or DC motor).
- In case of using a flange to install the motor to the slew drive it is recommended to apply gasket sealant between both surfaces or install an O-ring between both parts.
- ⚠ • Keep the plug properly closed to prevent water ingress. Only open the plug when connecting the cable.

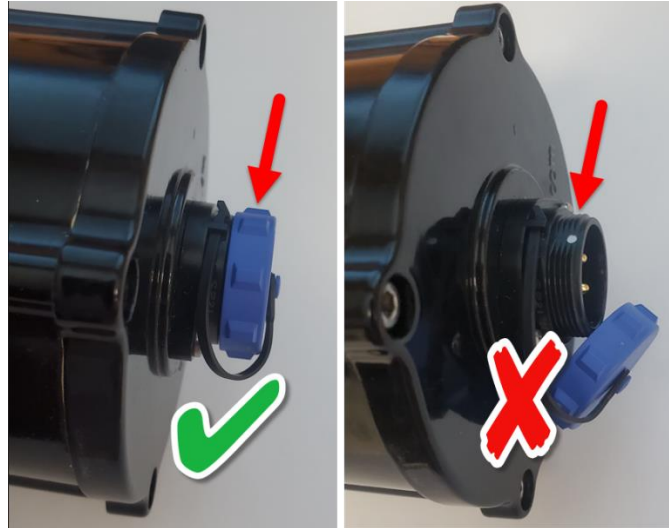


Image 5: Motor plug detail (closed & opened).

- ⚠ • Ensure **correct tightening** (indicated by the connector manufacturer) of the **various parts of the connector** (the thread on the engine connector and the thread sealing the cable gland). Leaving these components loose or incorrectly tightened means that water will enter the engine from inside the connector.

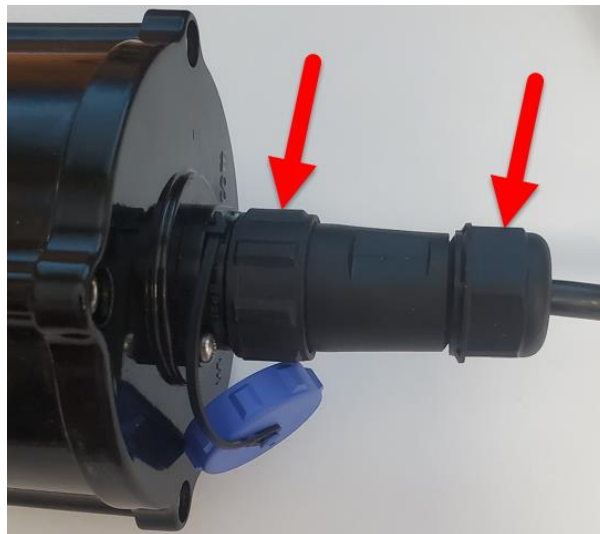


Image 6: Installed connector detail.

- ⚠ • Connect it to the power supply. (**NOTE: fix the cable to the motor** to prevent the damage of connector and sealing lost. The cable must go downwards to help the water evacuation.)



Image 7: Cable fixation detail on the motor.

- i** • As an additional protection method, some manufacturers cover this area of the engine. Example: plastic cap or thermoplastic.

4. Operation test

If the mounting bolts are properly tightened and the drive motor is correctly connected, then the slew drive shall rotate uniformly. Deviations of the mounting structure and the effect of extraneous loads can strongly impact the friction torque.

- Rotate mounted slew drive several times.
- Check whether slew drive runs smoothly without ripple.
- Perform further test under full load.
- After operation test, recheck the tightening torques of mounting bolts.

5. Periodic maintenance / safety checks and lubrication

5.1. Checking mounting bolts

To compensate the possible settling, it is necessary to retighten the bolts to the prescribed torque. This shall be done after no more than 100 hours of the first operation and without external load applied to the bolt connection. It is recommended to inspect the bolts every year (using the marks done during assembly) and retighten the bolts if necessary. If the slew drive is supplied with motorization (reducer or motor) then the bolts that fix those parts between them and to the drive should also be checked.

The inspection frequency may be reduced under special working and weather conditions. In case of loose bolts, replace those bolts, nuts and washers with new ones.

5.2. Re-lubrication of slew drive

Suitable substitute lubricants can be found in *Table 3*. Manufacturer provisions about handling the respective lubricants must be observed.

For old slew drives models with plug and grease type 00, please use the old maintenance manual for these models.

Suitable grease types for re-greasing:

Recommended grease type	Mineral or Synthetic grease. (In case of Synthetic grease type, ensure that is 100% compatible with any mineral grease.)
EP (Extreme Pressure)	YES
Consistency NLGI (ISO2137)	Grade 2
Oil Separation	< 3%
Corrosion and water protection	YES
Acceptable Thickeners	Calcium, Lithium or Aluminium sulphates
Temperature range in °C	-25°C / +120°C
Base oil viscosity (at 40°C)	>150mm ² /s
Welding Load	>200kg

Table 3: Table of standard grease properties.

Follow the procedure below:

- Open the upper plug, to allow the air flow *(if a breather valve is installed it is not needed)*.
- To lubricate the bearings, inject grease on each grease nipples placed on the end caps. If there is a plug and no grease nipple, uncover, insert the grease with the appropriate tool and replace the plug. If only has a central grease nipple or plug, grease it from that greasing point. *(See table 4 for re-lubrication period, and table 5 for grease quantity)*.
- To lubricate the worm and gear ring, inject grease on central grease nipple placed on the housing. If there is a plug and no grease nipple, uncover, insert the grease with the appropriate tool and replace the plug. *(See table 4 for re-lubrication period, and table 5 for grease quantity)*.
- Close the upper plug at 10Nm *(if a breather valve is installed it is not needed)*.

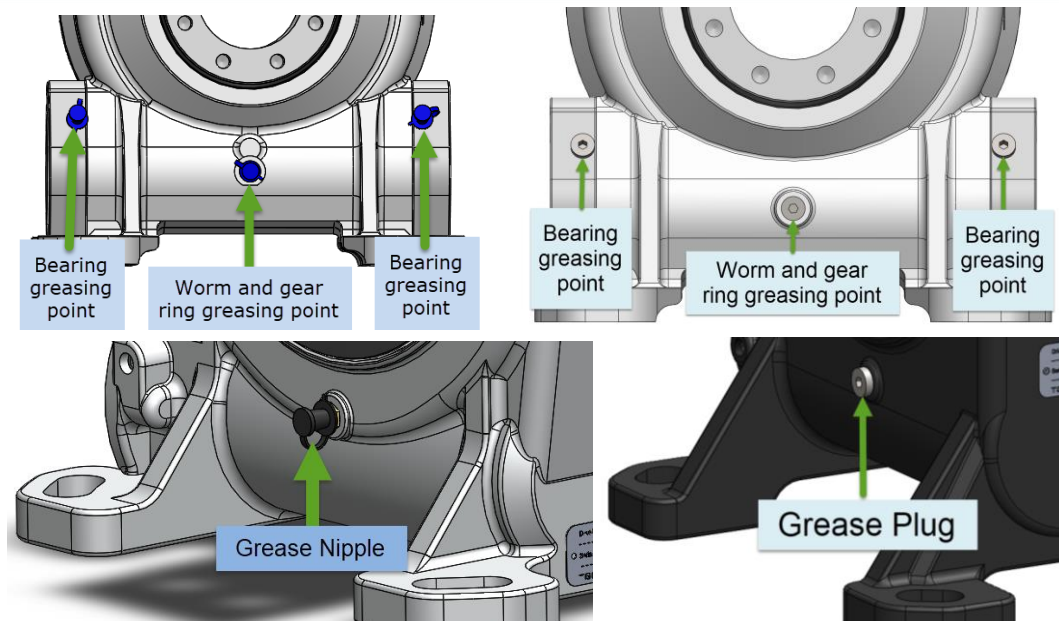


Image 8: Greasing points detail.

Re-lubrication is needed to assure a minimum quality on the grease inside the drive.
The following table can be used as a reference:

Slew Drive re-lubrication	
Normal Working conditions	Every 24 months
Extreme Working conditions	If strong winds or extreme temperatures where achieved it is recommended to re-grease the slew drive.

Table 4: Re-greasing intervals depending on working conditions.

Parts of the slew drive that need lubrication	Screw Worm & Gear ring	Bearings
Quantity of grease	0.3 x n° Drive (*)	10cc each one
Models with only 1 greasing point		
Quantity of grease	0.3 x n° Drive (*) + 20cc	

Table 5: Grease quantity for each part of the drive.

(*) Example: In TVR200 $\rightarrow 0.3 \times 200 = 60cc$

The values are valid for the following normal conditions:

- Temperature range: -20°C to 65°C.
- Nominal loads at least 90% of time.
- Speed <0.1rpm.

Do not exceed the times marked in the table.

6. Last indications

The instructions give you the information you need to be able to correctly install and maintain a TGB Slew drive.

Please always check that you are working with the latest revision.

These instructions shall be sent to all new customers. All work steps listed here are to be executed by suitably qualified personnel.

Please do not hesitate to contact our Engineering Department for any further assistance. All the information in this document has been carefully evaluated and checked. We do not, however, accept responsibility for any omissions or errors.

TGB accepts no liability for:

1. Non-compliance with Installation and Maintenance Instructions
2. Failure to pass on content to third part.



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